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The first zoeal stage of *Hyastenus elongatus* (Ortmann, 1893) (Decapoda, Brachyura, Majidae)

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ABSTRACT

The first zoeae of *Hyastenus elongatus* (Ortmann, 1893) were obtained in the laboratory from hatching. They are described, illustrated in detail and compared with the previously described zoeae of the subfamily Pisinae. The zoeae of *H. elongatus* are similar to, but may be distinguished from those of *Hyastenus diacanthus* (De Haan, 1839), by the number of setae on the postero-lateral carapace margin and mouthpart appendages, and the length of a dorsal carapace spine. In the mouthpart appendages, the difference in the number of setae on an endopod of the maxillule between *H. elongatus* and *H. diacanthus* is doubtful, and it should be necessary to make a detailed re-description of *H. diacanthus*.

Key words: Zoea, *Hyastenus elongatus, H. diacanthus,* Pisinae, Korean Brachyura.

INTRODUCTION

The family Majidae, including approximately 900 species, is widely distributed in marine waters (Provenzano and Brownell, 1977) and divided into seven subfamilies in Korea (Kim, 1973): Inachinae, Oregoniinae, Ophthalmiinae, Acanthonychinae, Pisinae, Majinae, and Mithracinae. The subfamily Pisinae includes the largest number of genera and species of any of the majid subfamilies, and *Hyastenus*, by far the largest genus in the Indo-west Pacific contains 34 species (Griffin and Tranter, 1986). Three species of *Hyastenus* have been recorded in Korea (Kim, 1973): *H. diacanthus* (De Haan), *H. elongatus* (Ortmann), and *H. pletone* (Herbst). *Hyastenus elongatus* occurs from Korea to Japan waters and on the bottoms of sand, sandy mud or weedy rock in depths from about 30 m to 100 m (Sakai, 1976).

Knowlege of larval development in the subfamily Pisinae is sparse. The larval developments of *Pisoides edwardsi* (Bell), *P. ortmanni* (Balss), *Libidoclaea granaria* (H. Milne Edwards), *Rochinia carpenteri* (Thomson), *Pisa armata* (Latreille), *Eurynome aspera* (Pennant), *E. spinosa* Hailstone, *Eurynolambrus australis* H. Milne Edwards & Lucas, *Libinia spinosa* H. Milne Edwards, *L. emarginata* Leach, *L. dubai* H. Milne Edwards, *Hyastenus diacanthus, H. elongatus, Naxioides histrix* (Miers), *Phalangipus hystrix* (Miers), and *Doclea ovis* (Herbst) were described (Boschi and Scelzo, 1968; Fagetti, 1969a, b; Kurata, 1969; Sandifer and Van Engel, 1971; Johns and Lang, 1977; Ingle, 1979; Ingle and Clark, 1980; Webber and Wear, 1981; Salman, 1982; Terada, 1983; Hong, 1988).

The complete larval development of *H. elongatus* was described by Terada (1983), however, his description concerning to the zoeal appendages is too brief for comparative study. Hence, there needs a detailed re-description.

The purpose of the present paper is to describe the first zoeal stage of *H. elongatus* in detail and compare it with the previously described larvae of the subfamily Pisinae.

MATERIALS AND METHODS

In October 1996 an ovigerous female of *Hyastenus elongatus* was collected by Scuba about 20 m depth in Yokji Island, Tongyoung, Kyung Sang Nam Do, Korea. In the laboratory, it was mantained in an aquarium containing sea water (salinity 33.3‰) at a constant temperature 25°C. When the eggs hatched, some larvae were immediately preserved in 10% neutral formalin for later examination. The remaining larvae were fed on newly hatched nauplii of Artemia every day. The larvae were moved daily into new containers with freshly filtered sea water.

Specimens and exuviae of each developmental stage were preserved in 10% neutral formalin. Drawings were made using a camera lucida and measurements were based on the mean of 10 specimens. The chromatophore patterns were determined by observation of living larvae.

RESULTS

The first zoeal stage lasts for 5 days. Most of them died during moulting to the second zoeae. Only two individuals of the second zoeae were obtained.

First Zoea (Fig. 1)

Size. Carapace length 0.84 mm. Distance from tip of dorsal spine to tip of rostrum 1.20 mm.

Carapace (Fig. 1A). Dorsal spine slightly curved and long. Rostral spine approximately equal in length to antennular peduncle. Postero-lateral margin with 5 setae and majid seta.

Antennule (Fig. 1B) with 2 aesthetascs and small simple seta.

Antenna (Fig. 1C). Exopod slightly shorter than the spinous process, armed a number of small spinules along distal part and 2 subterminal spines. Endopod bud half length to exopod.

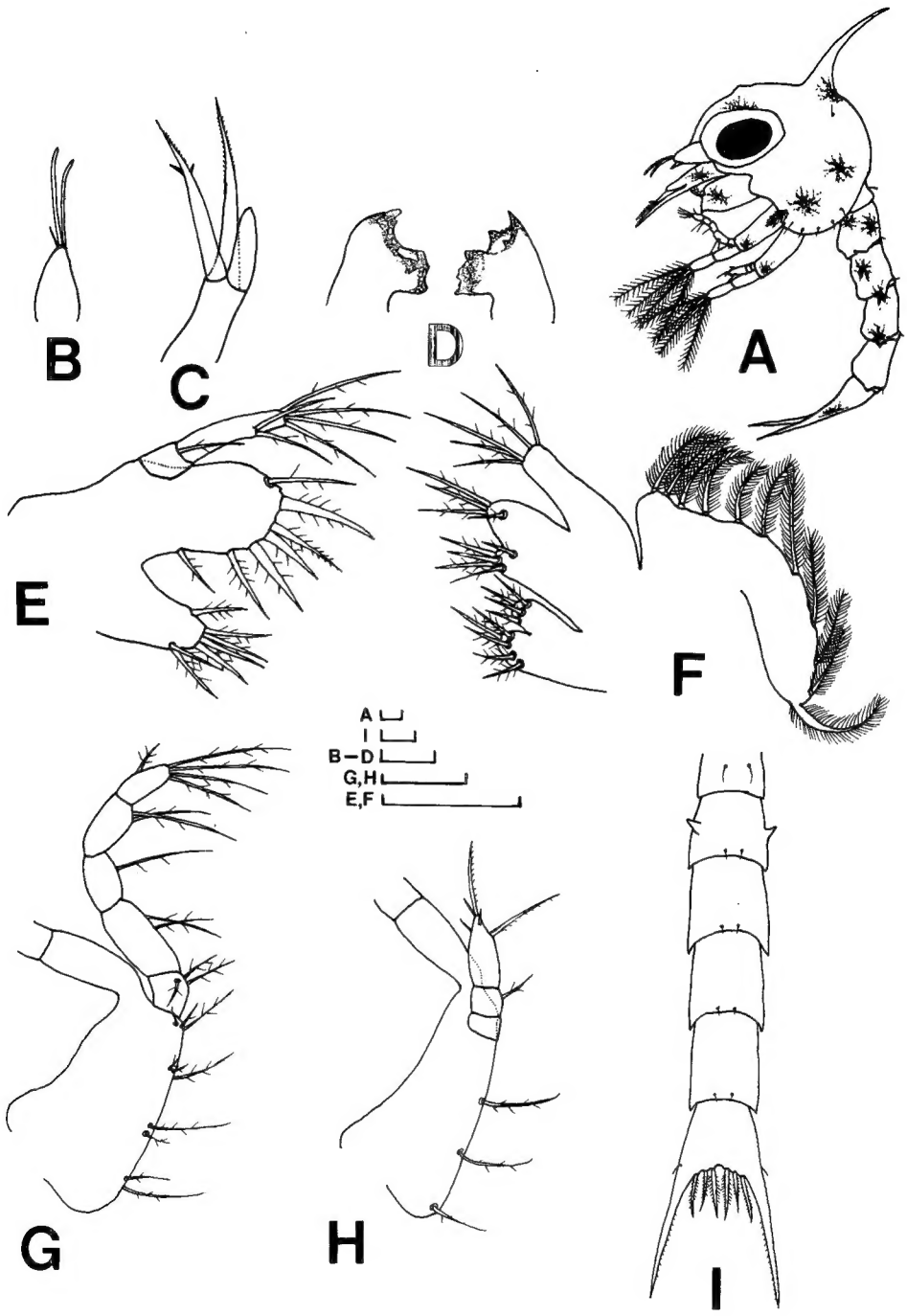

Fig. 1. *Hyastenus elongatus* (Ortmann, 1893), first zoeal stage, A, lateral view; B, antennule; C, antenna; D, mandible; E, maxillule; F, maxilla; G, first maxilliped; H, second maxilliped; I, dorsal view of abdomen and telson. Scale bars= 0.1 mm.

Mandibles (Fig. 1D) asymmetrical.

Maxillule (Fig. 1E). Endopod2-segmented; distal segment with 4 terminal and 2 subterminal plumodenticulate setae; proximal segment with plumodenticulate seta. Basal and coxal endites both with 7 plumodenticulate setae.

Maxilla (Fig. 1F). Endopod with 3+2 plumodenticulate setae. Basal and coxal endites both with 9 plumodenticulate setae. Scaphognathite bearing 11 marginal plumose setae.

First maxilliped (Fig. 1A, G). Basipod with 2, 2, 3 and 3 plumodenticulate setae, endopod 5-segmented with 3, 2, 1, 2 and 1+4 plumodenticulate setae. Exopod with 4 plumose natatory setae.

Second maxilliped (Fig. 1A, H). Basipod with 1, 1, and 1 plumodenticulate seta. Endopod 3-segmented with 0, 1 and 5 plumodenticulate setae. Exopod with 4 plumose natatory setae.

Abdomen (Fig. 1A, I) composed of 5 somites: somites 1-5 each with pair of dorso-median setae and somite 2 with lateral knobs.

Telson (Fig. 1A, I) with minute lateral spine on each side at base of fork. Each half with 3 long denticulate setae and inner seta longest. Telson fork with fine spinules.

Chromatophore (Fig. 1A) varied from yellow to red with variable black and brown spots. These occur on bases of antenna, labrum and mandible, between eyes, on lateral expansion of carapace, on abdominal somites 1-4 and telson, on basipods of maxillipeds 1, 2 and at base of dorsal spine.

DISCUSSION

Terada (1983) described the complete larval developments of *Hyastenus elongatus*, however, there was no data about setae on the postero-lateral carapace margin, the basal and coxal endites of the maxilla, the first abdominal somite, and the telson fork in the first zoea. In the chracteristic of the antennule, the first zoea reared in the present study somewhat differs from that described by Terada (1983). The present zoea has 2 aesthetascs plus seta, whereas his zoea has 2 aesthetascs plus 3 setae. Moreover, he reported his zoea had no lateral spine on a telson. According to the presence or absence of the lateral spine, he provided a provisional key for the identification of ten species of Pisinae zoeae. But the present zoea has one lateral spine. In the respect of the most Pisinae zoeae, including *Hyastenus diacanthus*, having one lateral spine on the telson (except in genera *Eurynome* and *Doclea*), such morphological difference might be resulted from a lack of detailed examination, rather than genetic or geographical variations.

Ingle (1992) reported a key to the larval stages of Northeastern Atlantic brachyurans. He considered that "exopods of maxillipeds 1, 2 with 4 setae and scaphognathite with at least 9 setae or exopods with 6 setae and scaphognathite with at least 15 setae combined with well-developed pleopod buds, telson furcae usually with conspicuous minute denticulettes and a majid seta usually developed" as a characteristics of the family Majidae zoeae. Not only the subfamily Pisinae zoeae show the same characterisitcs as mentioned above, but also, they show the following characteristics: dorsal spine length is varied from about 1.5A (A= antennular peduncle length) to 6A; rostral spine is from vestigial to 3A; lateral spine is absent (except in *Rochinia carpentari*); exopod of antenna is equal or slightly shorter than spinous process and has 2 medial or subterminal setae (except in *Eurynolambrus*

Table 1. Comparison of characteristics of known first zoeae in the subfamily Pisinae

Species	Carapace DS	RS	LS	Antenna Exopod	Maxillule Endopod	Maxilla Endopod	Maxilliped 2 Endopod	Sources
Hyastenus								
H. elongatus	2A	1A	-	2 subterminal setae	1, 2+4	2+3(5)	0, 1, 5	Present study
H. diacanthus	3A	1A	-	2 subterminal setae	1, 5	2+3(5)	0, 1, 4(5)	Kurata, 1969
Eurynolambrus								
E. australis	1.5A	2A	-	3 terminal setae	1, 2+4	2+3(5)	0, 1, 6	Webber & Wear, 1981
Pisoides								
P. edwardsi	1.5A	1.5A	-	2 subterminal setae	1, 2+4	2+3(5)	1, 1, 4	Fagetti, 1969a
P. ortmanni	6A	1A	-	2 subterminal setae	1, 4	4	0, 1, 4	Kurata, 1969
Rochinia								
R. carpentari	3A	3A	+	2 subterminal setae	1, 2+4	3+3(6)	0, 1, 5	Ingle, 1979
Naxoides								
N. histrix	4A	1A	-	2 subterminal setae	1, 6	5	0, 1, 4	Kurata, 1969
Libidoclaea								
L. granaria	5A	2A	-	2 medial setae	1, 1+4	3+3(6)	0, 1, 5	Fagetti, 1969b
Phalangipus								
P. histrix	3A	1A	-	2 subterminal setae	1, 2+4	4(5)	0, 1, 4	Terada, 1983
Doclea								
D. ovis	5.5A	0.5A	-	2 subterminal setae	1, 2+4	5	0, 1, 4	Terada, 1983
Pisa								
P. armata	3A	Vestigial	-	2 subterminal setae	1, 2+4	5	1, 1, 5	Ingle & Clark, 1980
Eurynome								
E. aspera	3A	2A	-	2 medial setae	1, 2+4	2+3(5)	1, 1, 5	Salman, 1982
E. spinosa	3A	1.5A	-	2(3) terminal setae	1, 2+4	2+3(5)	1, 1, 5	Hong, 1988
Libinia								
L. spinosa	3A	1A	-	2 subterminal setae	1, 1+4	2+3(5)	0, 1, 4	Boschi & Scelzo, 1968
L. emarginata	3A	1A	-	2 subterminal setae	1, 1+4	2+3(5)	0, 1, 4	Johns & Lang, 1977
L. dubai	3.5A	1.5A	-	2 subterminal setae	1, 1+4	2+3(5)	0, 1, 4	Sandifer & Van Engel, 1971

* A= antennular peduncle length, + or - = present or absent, DS= dorsal spine, RS= rostral spine, and LS= lateral spine.

australis and *Eurynome spinosa* having 2 or 3 terminal setae); endopod of maxillule has always seta on proximal segment and usually 2+4(6) or 1+4(5) setae on distal segment (except in *Pisoides ortmanni* having 4); endopod of maxilla has usually 2+3(5) setae (except in *R. carpentari* and *Libidoclaea granaria* having 3+3, in *P. ortmanni* having 4 setae); endopod of first maxilliped has 3, 2, 1, 2, 5 setation and basipod has usually 2, 2, 3, 3 setation (except in *Eurynolambrus australis*

having 2, 2, 2, 3); endopod of second maxilliped is usually naked on proximal segment (except in *Pisa armata*, *Pisoides edwardsi*, and *Eurynome* having seta), always has a seta on intermediate segment, and usually 4 or 5 setae on distal segment (except in *Eurynolambrus australis* having 6) and basipod has usually 1, 1, 1 setation; abdomen has 2 dorso-median setae on somite 1, lateral knobs on somite 2, and small postero-lateral process on somites 3 and 4 (except in *R. carpentari*, *Naxioides histrix*, *L. granaria*, *Libinia spinosa*, and *Phalangipus hystrix* having acute postero-lateral process); telson has outer seta on each side (except in *Eurynome* and *Doclea*).

According to Table 1, the larval study is restricted to only one species in the genera *Eurynolambrus*, *Rochinia*, *Naxoides*, *Libidoclaea*, *Phalangipus*, *Doclea* and *Pisa*, therefore, it is impossible to compare zoeal characteristics within a genus. Among the genera *Hyastenus*, *Pisoides*, *Eurynome*, and *Libinia*, the *Libinia* is the most homogeneous group. But, the *Pisoides* is very heterogeneous because the zoea of *P. edwardsi* greatly differs from that of *P. ortmanni*. Griffin and Tranter (1986) recognized that two distinct genera might be warranted for *P. edwardsi*, *P. ortmanni and P. bidentatus* (A. Mine Edwards). Their recognition may be supported on the base of larval evidence. In *Hyastenus*, *H. diacanthus* shows almost the same characteristics to the *Libinia* is quite interesting.

Some differences exist between *H. elongatus* and *H. diacanthus*: the *H. elongatus* has long plumose seta (majid seta) plus 5 short setae on the postero-lateral carapace margin, but *H. diacanthus* has long plumose seta plus 4 short setae; the length of dorsal carapace spine is about 2A in *H. elongatus*, but 3A in *H. diacanthus*; the endopod setation of the second maxilliped is 0, 1, 5 in *H. elongatus*, but usually 0, 1, 4 in *H. diacanthus*; the endopod of the maxillule has 6 setae on the distal segment in *H. elongatus*, whereas it has 5 in *H. diacanthus*. Consequently, the zoea of *H. elongatus* can be easily distinguished from that of *H. diacanthus* by the above mentioned characteristics. Also, it is doubtful that two species zoeae belonging to the same genus have different numbers of setae on the endopod of a maxillule. The number of setae on endopod of the maxillule is generally accepted as an important characteristic because of constant in the generic level. Therefore, it is necessary to exam and provide a detailed re-description of the zoeae of *H. diacanthus* because Kurata (1969)' s description was too brief for a comparison.

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박뿔게 (십각목, 단미류, 물맞이게과)의 제1 조에아 유생

고 현 숙
(부산여자대학교 자연대학 생물학과)

요 약

실험실에서 포란한 박뿔게로부터 제1 조에아 유생을 얻었다. 제1 조에아 유생기의 형태적 특징을 상세히 기재 및 도시하고 이미 보고된 뿔게아과 다른 종의 조에아 유생들과 그 형태적 특징을 비교하였다. 박뿔게와 뿔게의 제1 조에아 유생은 형태적으로 유사하나 감각후측연부와 구기부속지의 강모수와 등가시의 길이가 서로 다르다. 특히, 구기부속지중 제1 소악의 내지 강모수가 다르기 때문에 뿔게유생에 대한 상세한 재기재를 필요로 한다.